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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Shahram Mihan et al.	:	Group Art Unit: 1793
Ser. No. 10/588,391	:	Examiner: Pritesh Darji
Filed: August 4, 2006	:	
For: PREPARATION OF SUPPORTED CATALYSTS FOR POLYMERIZATION	:	

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF UNDER 37 C.F.R. § 41.37

Sir:

Please enter the following Brief in response to the final Office action mailed May 11, 2009. Appellants filed a Notice of Appeal on July 28, 2009. The Office has been authorized to charge Deposit Account No. 08-2336 for the requisite fee for this Brief.

I. Real Party in Interest

The real party in interest for the application is Basell Polyolefine GmbH, Bruhler Strasse 60, 50389 Wesseling, Germany, a company of LyondellBasell Industries, with headquarters at P.O. Box 2416, 3000 CK Rotterdam, The Netherlands.

II. Related Appeals and Interferences

There are no other prior or pending appeals, interferences, or judicial proceedings known to Appellants, Appellants' legal representative, or the assignee which may relate to, directly affect, or be directly affected by or have a bearing on the Board's decision in this appeal.

III. Status of Claims

Claims 1, 3-15, and 18-31 stand rejected and are being appealed. Claims 2, 16, and 17 have been cancelled.

IV. Status of Amendments

An amendment after final rejection was filed on July 9, 2009. In an Advisory Action mailed July 23, 2009, the Examiner indicated that the amendment would be entered but the final rejection would be maintained.

V. Summary of Claimed Subject Matter[1]

Appellants' claims define supported catalysts (claims 7, 8, 25), a process for making them (claims 1, 3-6, 18-24), and use of the supported catalysts to polymerize olefins (claims 9-15, 26-31). See also application, p. 1, ll. 13-15. The supported catalysts are made by a process which comprises: (a) preparing a hydrogel; (b) milling the hydrogel to give a finely particulate hydrogel; (c) producing a slurry comprising the finely particulate hydrogel; (d) drying the slurry comprising the finely particulate hydrogel thereby forming a support for catalysts; and (e) applying a first treatment compound comprising at least one of a transition metal and transition metal containing compound to the support for catalysts, thereby forming the supported catalyst (claim 1 and application at p. 3, ll. 13-22). The finely particulate hydrogel of step (b) has a defined set of particle size ranges, i.e., the finely particulate hydrogel comprises:

- at least 5% by volume of the particles, based on the total volume of the particles, have a particle size in the range from > 0 μm to ≤ 3 μm; and
- at least 40% by volume of the particles, based on the total volume of the particles, have a particle size in the range from > 0 μm to ≤ 12 μm, and
- at least 75% by volume of the particles, based on the total volume of the particles, have a particle size in the range from > 0 μm to ≤ 35 μm

(see claim 1 and application at p. 3, ll. 23-29).

Appellants surprisingly found that particular supported catalysts prepared as described above provide polymers that have a lower fines content than similar catalysts for which one or more of the ranges of particle size falls outside Appellants' claimed range (application, p. 4, ll. 14-16; Table II, p. 41; paragraph bridging pp. 41 and 42). Appellants also found that certain metallocene catalysts when prepared according to the inventive process exhibit high productivity (Table III, p. 43; p. 43, ll. 6-9.) Finally,

[1] Unless indicated otherwise, page and line numbers refer to the Substitute Specification submitted as Attachment B by Appellants with their preliminary amendment on August 4, 2006.

Appellants discovered that when supported catalysts of the invention are used in a gas-phase olefin polymerization, the amount of fines discharged from the circulating gas cyclone and amount of polymer lumps formed are significantly reduced (Table IV, p. 44; p. 45, ll. 1-6).

VI. Grounds of Rejection to be Reviewed on Appeal

A. Whether claims 1, 3, 7-9, 12, 16-19, and 25 are unpatentable under 35 U.S.C. § 103(a) over Derleth (U.S. Pat. No. 5,716,898).

B. Whether claims 4, 20, and 21 are unpatentable under 35 U.S.C. § 103(a) over Derleth in view of Warthen (U.S. Pat. No. 5,714,424).

C. Whether claims 5, 6, and 22-24 are unpatentable under 35 U.S.C. § 103(a) over Derleth in view of Mihan (U.S. Pat. No. 6,469,111).

D. Whether claims 10, 11, and 26 are unpatentable under 35 U.S.C. § 103(a) over Derleth in view of Hlatky (U.S. Pat. No. 5,153,157).

E. Whether claims 13, 14, 27, and 28 are unpatentable under 35 U.S.C. § 103(a) over Derleth in view of Mihan.

F. Whether claims 15 and 19-31 are unpatentable under 35 U.S.C. § 103(a) over Derleth in view of Mihan and further in view of Brant (U.S. Pat. No. 5,712,352).

VII. Argument

A. Claims 1, 3, 7-9, 12, 16-19, and 25 are not unpatentable under 35 U.S.C. § 103(a) over Derleth (U. S. Pat. No. 5,716,898).

1. Derleth Fails to Teach or Suggest Finely Particulate Hydrogels Having the Claimed Particle Size Distributions

The Board should reverse the rejection of claims 1, 3, 7-9, 12, 16-19, and 25 under 35 U.S.C. § 103(a) as unpatentable over Derleth et al. (U.S. Pat. No. 5,716,898) in view of the following remarks. Derleth is discussed in detail because it is relied upon by the Examiner for all six pending rejections.

Derleth teaches a way to make silica supports for chromium catalysts useful for ethylene polymerization. The supports are "microspheroidal powders of low dispersity." The powders are produced by: (a) forming a hydrogel; (b) grinding the hydrogel either in the presence of water or before combining it with water (see col. 2., ll. 44-45); (c) forming

a suspension of the ground hydrogel and water; (d) atomizing the suspension by spray drying; (e) contacting the spray-dried particles with an organic liquid that assists in drying; and (f) drying the particles to remove traces of moisture and organic liquid.

Among the steps described by Derleth, the grinding step is most relevant to Appellants' claimed process and is worth a closer look. Derleth teaches that grinding is advantageously "controlled so as to obtain particles with a diameter of less than 50 μm, for example of between 5 and 40 μm, values of between 10 and 30 μm being preferred" (col. 2., ll. 47-50). Consistent with these teachings, Derleth later describes (see Example 1 at col 6,. ll. 46-49) a catalyst support preparation in which a hydrogel is formed, aged, and "treated in a colloid mill . . . A ground hydrogel in the form of 10 to 30 μm particles was collected from the mill and about 10% of water was added to this ground hydrogel."

In contrast, Appellants' claim 1 requires that the "finely particulate hydrogel," (i.e., the milled hydrogel from step b) comprise:

- at least 5% by volume of the particles, based on the total volume of the particles, have a particle size in the range from > 0 μm to ≤ 3 μm; and
- at least 40% by volume of the particles, based on the total volume of the particles, have a particle size in the range from > 0 μm to ≤ 12 μm, and
- at least 75% by volume of the particles, based on the total volume of the particles, have a particle size in the range from > 0 μm to ≤ 35 μm.

The requirement of claim 1 to have *at least 5 vol.% of particles having a particle size ≤ 3 μm* is not fairly taught or suggested by Derleth, which teaches hydrogels having a 10-30 μm range as most preferred. Moreover, claim 1 also requires *at least 40 vol.% of particles having a particle size ≤ 12 μm*, and *at least 75 vol.% of particles having a particle size ≤ 35 μm*. Of the three requirements, Derleth at best appears to disclose only the third one.

In contrast, see Appellant's Table I (application, p. 39), which shows five separate batches of milled hydrogels ("finely particulate hydrogels") produced by following steps (a) and (b) of the claimed process. For each batch, all three claim requirements are met. Batch 1, for instance, gave a milled hydrogel in which 10 vol.% of the hydrogel had a particle size less than 1.86 μm (meeting the at least 5 vol.% ≤ 3 μm limitation of claim 1). In the same batch, 50 vol.% of the hydrogel had a particle size less than 5.46 μm (meeting the at least 40 vol.% ≤ 12 μm limit), and 90 vol.% of the

hydrogel had a particle size less than 13.63 μm (meeting the at least 75 vol.% ≤ 35 μm limit).

The Examiner urges that the process would have been obvious from Derleth. In particular, he asserts that, with regard to the hydrogel particle sizes, it would have been obvious to select the "overlapping portion" of the range disclosed by the reference because "overlapping ranges have been held to be a prima facie case of obviousness" (Office action mailed 5-11-2009, p. 3). Further, (Office action mailed 5-11-2009, p. 4), "it would have been obvious . . . to have desired hydrogel particle sizes through controlled milling because differences in sizes do not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature [sic; read as 'particle size distribution'] is critical."

Appellants respectfully disagree that Derleth's disclosure is specific enough to make Appellants' claimed process prima facie obvious. Moreover, Appellants have provided experimental evidence sufficient to overcome any such prima facie case.

The Examiner invites us to select the "overlapping portion" of the ranges actually taught by Derleth to arrive somehow at the particularly claimed ranges required by Appellants' claim 1. Such a selection, however, is not possible without application of considerable hindsight and the benefit of Appellants' disclosure. What motivates the skilled person to pick just the portion of Darleth that "overlaps" the requirement of at least 5 vol.% of particles having a particle size ≤ 3 μm? A similar question can be asked related to Appellants' requirement of at least 40 vol.% of particles having a particle size ≤ 12 μm. Because Derleth's disclosure lacks specificity regarding the claimed particle size distribution, it is insufficient to support a prima facie case of obviousness.

In the Advisory Action mailed July 23, 2009, the Examiner remarked that "Derleth teaches grinding of hydrogel is controlled for making hydrogel's size less than 50 micrometers. Derleth further teaches size from 5 to 40 micrometer, which is very close to that instantly claimed of 3 micrometer." However, this just underscores the lack of specificity in the Derleth disclosure relative to Appellants' claimed ranges. Conversely, Appellants' compositions are not just "close" to 3 microns; the claims *require* that at least 5 volume % of the particles have a size less than 3 microns.

In sum, the Board should reverse the rejection because Derleth lacks the requisite degree of specificity to render the claimed finely particulate hydrogels or their method of preparation obvious.

2. Appellants' Experimental Evidence Outweighs Any Prima Facie Case of Obviousness Based on Derleth

The Examiner maintains that Appellants' catalysts (and process for making them) would have been obvious because a skilled person would have concluded that differences between the claimed particle size ranges and those taught by Derleth are small, and a skilled person would therefore have expected them to have the "same properties" (see Advisory action, continuation sheet). He argues that the "instant specification doesn't mention any unexpected and valuable advantages occurred by different size distribution." Moreover, a showing of unexpected results "must be based on objective evidence" rather than arguments of counsel. Finally, he argues that the showing provided is "not commensurate in scope with that instantly claimed because the showing is of much narrower scope of particle sizes" (Advisory action, continuation sheet).

Appellants provided considerable experimental evidence that milling the hydrogel to provide a particle size distribution within the claimed range provides unexpected and valuable advantages for olefin polymerization catalysis. The evidence outweighs any prima facie showing based on Derleth.

Appellants respectfully ask the Board to consider the results shown on pages 39-44 of the application. Five separate batches of hydrogels were milled to provide finely particulate hydrogels having the claimed particle size distribution (Table I, p. 39). Slurries of these hydrogels were spray dried, then used to support chromium compounds. The catalysts were activated and used to polymerize ethylene. As Table II (p. 41) shows, Appellants surprisingly found that catalysts of the invention, when compared with catalysts supported on ES 70X, a commercially available spray-dried support, provide a much lower proportion of "fines," i.e., polyethylene particles having a size < 125 μm (0.51-1.3 wt.% versus 6.4 wt.%) and < 250 μm (3-8 wt.% versus 20 wt.%). This could hardly have been "obvious" from Derleth. Additional advantages of the supported catalysts are summarized, supra, in Section V, pages 2-3.

Appellants' polymerizations using a supported metallocene (application, pp. 41-42) provide further evidence of patentability over Derleth. As Table III (p. 43) shows, a single metallocene complex supported on three different commercially available silicas failed to provide productivities comparable to catalysts made from the same complex and supports made by Appellants' claimed process. Anyway, Derleth fails to predict the

outcome of any experiment with metallocene catalysts because Derleth describes only Cr catalysts.

Appellants provided additional evidence of patentability in showing that metallocene catalysts made according to the invention, when used in a gas-phase polymerization of ethylene, produce a smaller amount of fine particles in the discharge from a circulating gas cyclone ("CGC fines") and fewer large lumps when compared with a commercial counterpart (see Table IV, p. 44). Again, Derleth, whose disclosure is limited to Phillips (Cr) catalysts, fails to make these advantages of Appellants' invention apparent.

It is clear from the above discussion that: (1) the instant specification does indeed teach "unexpected and valuable advantages" for olefin polymerizations that directly result from selection of catalysts supported using finely particulate hydrogels having the claimed particle size distributions; and (2) Appellants are relying on "objective evidence" rather than mere attorney arguments.

The Examiner argues that the claims are not commensurate in scope with the experimental showing. However, Table 1 demonstrates that the finely particulate hydrogels meet all three claim limitations (see claim 1). The claims define these compositions with reasonable precision. It is hard to imagine how the claims could be more commensurate in scope with the invention shown in the examples. It is also clear that Appellants' description is far more specific than that of Derleth with respect to particle size distributions of the hydrogels.

In sum, Derleth's disclosure is not specific enough to support a prima facie case of obviousness for Appellants' claimed process for preparing a supported catalyst. Additionally, even if it met this test, Appellants provided ample experimental evidence in the application as originally filed to rebut any such prima facie showing. The evidence demonstrates that catalysts that employ Appellants' supports outperform commercial alternatives in olefin polymerizations and provide benefits that could not have been predicted from Derleth and related teachings. The Board should reverse the rejection.

B. Claims 4, 20, and 21 are not unpatentable under 35 U.S.C. § 103(a) over Derleth in view of Warthen (U.S. Pat. No. 5,714,424).

The Examiner argues that claims 4, 20, and 21 are obvious from the combined teachings of Derleth and Warthen. Warthen teaches a "monolithic multicomponent

composite polyolefin catalyst particle" comprising at least two catalyst components, wherein each component provides a polyolefin resin having a different melt index. The Examiner relies on Warthen for its teaching to include a metallocene component.

Appellants have already explained why Derleth alone fails to render the claimed catalysts and process for making them obvious. Dependent claims 4, 20, and 21 incorporate all of the limitations of process claim 1. Therefore, if claim 1 is patentable, claims 4, 20, and 21 must also be patentable. The issue becomes whether the combined teachings of Derleth and Warthen render claim 1 obvious. In fact, the combined teachings are insufficient.

In particular, even the combined teachings of Derleth and Warthen fail to disclose with adequate specificity finely particulate hydrogels having the claimed particle size distributions. Adding Warthen's disclosure fails to remedy Derleth's deficiencies in this area. Warthen (Ex. 1, col. 5) simply mentions a milled hydrogel having an average particle size of "about 6.5μ." The combined teachings of Derleth and Warthen are therefore insufficient to render Appellants' claim 1 (or any dependent claim) obvious. Moreover, none of Appellants' experimental findings were apparent from the combined teachings of Derleth and Warthen. The Board should reverse the rejection.

C. <u>Claims 5, 6, and 22-24 are not unpatentable under 35 U.S.C. § 103(a) over Derleth in view of Mihan (U.S. Pat. No. 6,469,111)</u>.

The Examiner argues that claims 5, 6, and 22-24 are obvious from the combined teachings of Derleth and Mihan. Mihan teaches the use of MgO or ZnO antistatic agents for a gas-phase olefin polymerization. The Examiner relies on Mihan for its teaching to thermally activate catalysts at 400°C to 900°C.

Appellants have already explained why Derleth alone fails to render the claimed catalysts and process for making them obvious. Dependent claims 5, 6, and 22-24 incorporate all of the limitations of process claim 1. Therefore, if claim 1 is patentable, claims 5, 6, and 22-24 must also be patentable. The issue becomes whether the combined teachings of Derleth and Mihan render claim 1 obvious. In fact, the combined teachings are insufficient.

In particular, even the combined teachings of Derleth and Mihan fail to disclose with adequate specificity finely particulate hydrogels having the claimed particle size distributions. Adding Mihan's disclosure fails to remedy Derleth's deficiencies in this

area. Mihan (col. 4, ll. 1-12) mentions silica gels as suitable supports and says only that the "support materials preferably have a particle diameter of from 1 to 300 µm, in particular from 30 to 70 µm." The combined teachings of Derleth and Mihan are therefore insufficient to render Appellants' claim 1 (or any dependent claim) obvious. Moreover, none of Appellants' experimental findings were apparent from the combined teachings of Derleth and Mihan. The Board should reverse the rejection.

D. Claims 10, 11, and 26 are not unpatentable under 35 U.S.C. § 103(a) over Derleth in view of Hlatky (U.S. Pat. No. 5,153,157).

The Examiner argues that claims 10, 11, and 26 are obvious from the combined teachings of Derleth and Hlatky. Hlatky teaches metallocenes and their activation by alumoxanes or ionic borates. The Examiner relies on Hlatky for its teaching to use alumoxanes to activate metallocene-catalyzed olefin polymerizations.

Appellants have already explained why Derleth alone fails to render the claimed catalysts and process for making them obvious. Dependent claims 10, 11, and 26 incorporate all of the limitations of claim 1. Therefore, if claim 1 is patentable, claims 10, 11, and 26 must also be patentable. The issue becomes whether the combined teachings of Derleth and Hlatky render claim 1 obvious. In fact, the combined teachings are insufficient.

In particular, even the combined teachings of Derleth and Hlatky fail to disclose with adequate specificity finely particulate hydrogels having the claimed particle size distributions. Adding Hlatky's disclosure fails to remedy Derleth's deficiencies in this area. Hlatky (col. 15, ll. 40-46) mentions that the catalysts can be "supported" for a gas phase olefin polymerization but is otherwise silent regarding supports or particle size distributions. The combined teachings of Derleth and Hlatky are therefore insufficient to render Appellants' claim 1 (or any dependent claim) obvious. Moreover, none of Appellants' experimental findings were apparent from the combined teachings of Derleth and Hlatky. The Board should reverse the rejection.

E. Claims 13, 14, 27, and 28 are not unpatentable under 35 U.S.C. § 103(a) over Derleth in view of Mihan.

The Examiner argues that claims 13, 14, 27, and 28 are obvious from the combined teachings of Derleth and Mihan. The Examiner relies on Mihan for its teaching to use "mean particle diameters" of "10 to 200 micrometers." See Mihan at col. 2, ll. 27-53. Here, Mihan refers to the MgO or ZnO used as an antistatic agent, not to silicas used as a catalyst support.

Appellants have already explained why Derleth alone fails to render the claimed catalysts and process for making them obvious. Dependent claims 13, 14, 27, and 28 incorporate all of the limitations of process claim 1. Therefore, if claim 1 is patentable, claims 13, 14, 27, and 28 must also be patentable. The issue becomes whether the combined teachings of Derleth and Mihan render claim 1 obvious. In fact, the combined teachings are insufficient.

In particular, even the combined teachings of Derleth and Mihan fail to disclose with adequate specificity finely particulate hydrogels having the claimed particle size distributions. Adding Mihan's disclosure fails to remedy Derleth's deficiencies in this area. The particle sizes from Mihan (col. 2, ll. 47-53) refer to MgO or ZnO, not silica, so the values disclosed are irrelevant. The combined teachings of Derleth and Mihan are insufficient to render Appellants' claim 1 (or any dependent claim) obvious. Moreover, none of Appellants' experimental findings were apparent from the combined teachings of Derleth and Mihan. The Board should reverse the rejection.

F. <u>Claims 15 and 19-31 are not unpatentable under 35 U.S.C. § 103(a) over Derleth in view of Mihan and further in view of Brant (U.S. Pat. No. 5,712,352)</u>.

The Examiner argues that claims 15 and 19-31 are obvious from the combined teachings of Derleth, Mihan, and Brant. Brant teaches a continuous process for making polyolefins in the gas phase using metallocenes. The Examiner relies on Brant for its teaching to make polyolefin particles having particle sizes less than 125 micrometers.

Appellants have already explained why Derleth alone fails to render the claimed catalysts and process for making them obvious. Dependent claims 15 and 19-31 incorporate all of the limitations of claim 1. Therefore, if claim 1 is patentable, claims 15 and 19-31 must also be patentable. The issue becomes whether the combined teachings of Derleth, Mihan, and Brant render claim 1 obvious. In fact, the combined teachings are insufficient.

In particular, even the combined teachings of Derleth, Mihan, and Brant fail to disclose with adequate specificity finely particulate hydrogels having the claimed particle size distributions. Adding Brant's disclosure fails to remedy the deficiencies of Derleth and Mihan in this area. Brant (col. 5, ll. 14-35) teaches that silicas can be used, and the preferred particle size range is 10 to 500 μm. The combined teachings are thus no more informative than Derleth alone and are insufficient to render Appellants' claim 1 (or any dependent claim) obvious. Moreover, none of Appellants' experimental findings were apparent from the combined teachings of Derleth, Mihan, and Brant. The Board should reverse the rejection.

G. Conclusion

Appellants respectfully ask the Board of Appeals and Interferences to reconsider and reverse the Section 103(a) rejections.

I hereby certify that this correspondence is being deposited with the United States Postal Service as first-class mail, with sufficient postage, in an envelope addressed to: Commissioner for Patents, P.O. Box. 1450, Alexandria, VA 22313-1450 on September 24, 2009.

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Name of person signing

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Respectfully submitted,

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VIII. Claims Appendix

1. A process for preparing a supported catalyst which comprises:

a) preparing a hydrogel;

b) milling the hydrogel to give a finely particulate hydrogel;

c) producing a slurry comprising the finely particulate hydrogel;

d) drying the slurry comprising the finely particulate hydrogel thereby forming a support for catalysts;

e) applying a first treatment compound comprising at least one of a transition metal and transition metal containing compound to the support for catalysts, thereby forming the supported catalyst; and

f) optionally, activating the supported catalyst,

wherein the finely particulate hydrogel comprises:

- at least 5% by volume of the particles, based on the total volume of the particles, have a particle size in the range from > 0 μm to ≤ 3 μm; and
- at least 40% by volume of the particles, based on the total volume of the particles, have a particle size in the range from > 0 μm to ≤ 12 μm, and
- at least 75% by volume of the particles, based on the total volume of the particles, have a particle size in the range from > 0 μm to ≤ 35 μm.

2. (canceled)

3. The process of claim **1**, further comprising applying a second treatment compound to the treated support, wherein the second treatment compound comprises at least one of a transition metal and a transition metal containing compound.

4. The process of claim **1**, further comprising applying to the support for catalysts at least one complex of a transition metal.

5. The process of claim **1**, wherein the supported catalyst is activated by an activation process selected from the group consisting of at least one of thermal activation, oxidation, halogenation and addition of at least one activator compound.

6. The process of claim **1**, wherein the first treatment compound comprises chromium or a chromium containing compound, and the supported catalyst is activated by at least one of:

a) halogenation,

b) thermal activation in an oxidizing, reducing and/or neutral atmosphere, and

c) renewed thermal activation in a reducing atmosphere,

wherein the thermal activation is carried out in the range from 400°C to 1000°C.

7. A supported catalyst prepared by the process of claim **1**.

8. The supported catalyst of claim **7** further comprising a chromium content, based on the element, from 0.1% by weight to 5% by weight based on the total weight of the supported catalyst.

9. A process which comprises polymerizing or copolymerizing olefins with a supported catalyst, wherein the supported catalyst is prepared by the process of claim **1**.

10. The process of claim **9** wherein the polymerization and/or copolymerization is carried out in the presence of at least one activator compound.

11. The process of claim **10** wherein the activator compound is an organometallic compound.

12. The process of claim **9** wherein the polymerization or copolymerization is carried out as a gas-phase fluidized-bed process or a suspension process.

13. The process of claim **12** wherein the polymerization or copolymerization in the gas-phase fluidized-bed process and the supported catalyst has a mean particle size of the catalyst particles in the range from 30 μm to 300 μm.

14. The process of claim **12** wherein the polymerization or copolymerization is carried out in the suspension process and the supported catalyst has a mean particle size of the catalyst particles in the range from 30 μm to 350 μm.

15. The process of claim **13** wherein, in a polymerization or copolymerization in the gas-phase fluidized-bed process, the proportion of discharged polymer having a particle size in the range from > 0 μm to ≤ 125 μm is $\leq 15\%$ by weight based on the total weight of the product.

16-17. (canceled).

18. The process of claim **1** wherein the transition metals are selected from the group consisting of Ti, Zr, Cr, Fe, Ni, and Pd.

19. The process of claim **3** wherein the transition metals are selected from the group consisting of Ti, Zr, Hf, V, Cr, Fe, Co, Ni, Zn and Pd.

20. The process of claim **4** wherein the at least one complex of a transition metal is a metallocene compound.

21. The process of claim **20** wherein the metallocene compound comprises a transition metal selected from the group consisting of Ti, Zr, Hf, V, Cr, Fe, Co, Ni, Zn and Pd.

22. The process of claim **5** wherein the thermal activation is calcination.

23. The process of claim **5** wherein the halogenation is fluorination.

24. The process of claim **6** where the thermal activation is carried out in the range from 450°C to 900°C.

25. The supported catalyst of claim **8** wherein the chromium content is from 0.2% by weight to 1.5% by weight.

26. The process of claim **11** wherein the organometallic compound comprises a metal selected from the group consisting of B, Al, Zn and Si.

27. The process of claim **13** wherein the mean particle size of the catalyst particles are in the range from 40 μm to 100 μm.

28. The process of claim **14** wherein the mean particle size of the catalyst particles are in the range from 40 μm to 100 μm.

29. The process of claim **15** wherein the proportion of discharged polymer having a particle size in the range from > 0 μm to ≤ 125 μm is ≤ 5% by weight.

30. The process of claim **29** wherein the proportion of discharged polymer having a particle size in the range from > 0 μm to ≤ 125 μm is ≤ 3% by weight.

31. The process of claim **30** wherein the proportion of discharged polymer having a particle size in the range from > 0 μm to ≤ 125 μm is from 0.3% by weight to 2% by weight.

IX. Evidence Appendix

Not applicable

X. Related Proceedings Appendix

Not applicable